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## **DHEC Health Advisory**

Distributed via Health Alert Network  
January 10, 2005, 18:20 EDT

### **CHLORINE GAS TOXICITY, HEALTH EFFECTS AND MANDATORY REPORTING**

#### **Background Information**

At 2:40 AM on January 6, 2005, a Norfolk Southern Railway train traveling at 45 mph missed a switch and ran into a parked locomotive at a textile mill in Graniteville, South Carolina. This resulted in the release of approximately 90 tons of chlorine from one tanker car destroyed in the impact and approximately 60 tons of chlorine from a second tanker car that was punctured. To date, there have been nine confirmed fatalities. It is estimated that at least 324 people have been evaluated at local hospitals in Aiken, West Columbia, and Barnwell, SC and in four hospitals in neighboring Augusta, GA. An estimated 70 people were admitted, of which approximately 35 remain hospitalized in four hospitals. Several people who were released from medical observation have been admitted for medical care because of severe late manifestations of chlorine gas toxicity.

#### **Clinical Information**

Chlorine gas is a severe pulmonary irritant. It reacts with water in mucous membranes to form hydrochloric acid and hypochlorous acid. Toxic manifestations are determined by the concentration and duration of exposure to chlorine gas.

Short-term effects of acute exposures may include any of the following:

- Laryngospasm and laryngeal edema
- Necrosis of tracheal and bronchial epithelium
- Chemical pneumonitis from sloughing of mucosa within 3-5 days
- Secondary bacterial invasion often follows chemical pneumonitis
- Pulmonary edema. \*\*
- Hypochloremic metabolic acidosis has also been reported
- Persistent hypoxemia is correlated to a higher mortality rate
- Bronchopneumonia may also be a complication
- Smokers and those with asthma are most likely to demonstrate persistence of obstructive pulmonary defects

**\*\*Please note:** Late pulmonary edema due to chlorine exposure may occur after initial clinical improvement and/or release from acute medical care. Repeat patient visits several days after acute exposure, with worsened clinical condition, is not uncommon.

Given the limited information available on residual effects following acute exposures medical practitioners should also be alert for other lesser-known medical complications that may present after chlorine exposure has ended and clinical improvement has been observed.

Residual effects following acute exposure include decreased vital capacity, diffusing capacity, and total lung capacity with a trend towards higher airway resistance. This suggests that persistent dose-related lung function deficits may occur following acute chlorine gas exposure. Cigarette smokers are more likely than nonsmokers to be affected by long-term sequelae after acute chlorine gas exposure. Reactive airway dysfunction syndrome (RADS), or irritant induced asthma may develop and be persistent. Bronchiolitis obliterans and emphysema have been described in patients following acute exposures. Some patient may have eventual repair of injured pulmonary epithelium with fibrosis.

Most individuals who have had limited exposure to chlorine gas will experience resolution of pulmonary abnormalities over the course of one week to one month following exposure.

### **General guidelines for treatment of chlorine gas exposure**

Acute exposure treatment includes: supplemental oxygen, bronchodilators for airway restriction/irritation and appropriate treatment for pulmonary edema. Nebulized sodium bicarbonate use is controversial. Use of parenteral steroids for prevention of short and long term sequelae is also controversial, though some studies show improvement in animal models with inhaled steroids alone and in conjunction with oral steroids. Prophylactic antibiotic use is not recommended.

### **Reporting of patients with illness or disease related to chlorine gas exposure**

Please report to your local public health department all patients with illness or injury related to the Graniteville chlorine exposure incident seen in ED, hospital admissions or office visits since Thursday January 6, 2005. Please note that reporting of patients to the health department should include any presentation of a late manifestation or a complication of the initial exposure.

A later DHEC Health Advisory will discuss follow-up of late complications of chlorine gas exposure.

Reporting of patients is consistent with South Carolina Law requiring the reporting of diseases and conditions to your state or local public health department. (State Law # 44-29-10 and Regulation # 61-20) as per the DHEC 2004 List of Reportable Conditions available at: <http://www.scdhec.net/hs/diseasecont/disease.htm>.

Federal HIPAA legislation allows disclosure of protected health information, without consent of the individual, to public health authorities to collect and receive such information for the purpose of preventing or controlling disease. (HIPAA 45 CFR §164.512).

### **References and additional sources of information**

Winder C. The toxicology of chlorine. Environ Res. 2001 Feb;85(2):105-14.

Wang J, Zhang L, Walther SM. Administration of aerosolized terbutaline and budesonide reduces chlorine gas-induced acute lung injury. J Trauma. 2004 Apr;56(4):850-62.

Williams JG. Inhalation of chlorine gas. Postgrad Med J. 1997 Nov;73(865):697-700.

## Additional Sources for information

- Centers for Disease Control and Prevention website
  - Chlorine fact sheet ([www.bt.cdc.gov/agent/chlorine/basics/facts.asp](http://www.bt.cdc.gov/agent/chlorine/basics/facts.asp))
- Agency for Toxic Substances and Disease Registry
  - Chlorine Toxicology Frequently Asked Questions ([www.atsdr.cdc.gov/tfacts172.html](http://www.atsdr.cdc.gov/tfacts172.html))
  - Medical Management Guidelines ([www.atsdr.cdc.gov/MHMI/mmg172.html](http://www.atsdr.cdc.gov/MHMI/mmg172.html))

## District Public Health Offices

Mail or call reports to the District Epidemiology/Disease Reports office in each district.

### Appalachia I

**(Anderson, Oconee)**

220 McGee Road  
Anderson, SC 29625  
Phone: (864) 231-1966  
Fax: (864) 260-5623  
Nights / Weekends: 1-(866)-298-4442

### Appalachia II

**(Greenville, Pickens)**

PO Box 2507  
200 University Ridge  
Greenville, SC 29602-2507  
Phone: (864) 282-4139  
Fax: (864) 282-4373  
Nights / Weekends: (864) 460-5355 or  
1-800-993-1186

### Appalachia III

**(Cherokee, Spartanburg, Union)**

PO Box 4217  
151 E. Wood Street  
Spartanburg, SC 29305-4217  
Phone: (864) 596-2227 ext. 210  
Fax: (864) 596-3443  
Nights / Weekends: (864) 809-3825

### Catawba

**(Chester, Lancaster, York)**

PO Box 817  
1833 Pageland Highway  
Lancaster, SC 29721  
Phone: (803) 283-3175  
Fax: (803) 283-0572  
Nights / Weekends: 1-(866)-867-3886 or  
1-(888)-739-0748

### Edisto Savannah

**(Aiken, Allendale, Barnwell)**

1680 Richland Avenue, W. Suite 40  
Aiken, SC 29801  
Phone: (803) 642-1618  
Fax: (803) 642-1619  
Nights / Weekends: (803) 827-8668 or  
1-800-614-1519

### Edisto Savannah

**(Bamberg, Calhoun, Orangeburg)**

PO Box 1126  
1550 Carolina Avenue  
Orangeburg, SC 29116  
Phone: (803) 533-7199  
Fax: (803) 536-9118  
Nights / Weekends: (803) 954-8513

### Low Country

**(Beaufort, Colleton, Hampton, Jasper)**

1407 King Street  
Beaufort, SC 29902  
Phone: (843) 525-7603  
Fax: (843) 525-7621  
Nights / Weekends: 1-800-614-4698

### Palmetto

**(Fairfield, Lexington, Newberry, Richland)**

2000 Hampton Street  
Columbia, SC 29204  
Phone: (803) 576-2749  
Fax: (803) 576-2993  
Nights / Weekends: (803) 304-4252

### Pee Dee

**(Chesterfield, Darlington, Dillon,  
Florence, Marlboro, Marion)**

145 E. Cheves Street  
Florence, SC 29506  
Phone: (843) 661-4830  
Fax: (843) 661-4859  
Nights / Weekends: (843) 660-8145

### Trident

**(Berkeley, Charleston, Dorchester)**

4050 Bridge View Drive, Suite 600  
N. Charleston, SC 29405  
Phone: (843) 746-3832  
Fax: (843) 746-3851  
Nights / Weekends: (843) 219-8470

### Upper Savannah

**(Abbeville, Edgefield, Greenwood,  
Laurens, McCormick, Saluda)**

PO Box 3227  
1736 S. Main Street  
Greenwood, SC 29646  
Phone: 1-888-218-5475  
Fax: (864) 942-3690  
Nights / Weekends: 1-800-420-1915

### Waccamaw

**(Georgetown, Horry, Williamsburg)**

2830 Oak Street  
Conway, SC 29526-4560  
Phone: (843) 365-3126  
Fax: (843) 365-3153  
Nights / Weekends: (843) 381-6710

### Wateree

**(Clarendon, Kershaw, Lee, Sumter)**

PO Box 1628  
105 North Magnolia Street  
Sumter, SC 29150  
Phone: (803) 773-5511  
Fax: (803) 773-6366  
Nights / Weekends: 1-(877)-831-4647

### Bureau of Disease Control

Acute Disease Epidemiology Division  
1751 Calhoun Street  
Box 101106  
Columbia, SC  
Phone: (803) 898-0861  
Fax: (803) 898-0897  
Nights / Weekends: 1-888-847-0902